REMARKS

Claims 1-17 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Chang (US 6,023,060) in view of Lee (US 6,281,508). The rejection is respectfully traversed for the reasons discussed below.

Chang is directed to a T-shaped electron beam microcolumn for use as a general purpose SEM; however, the Office Action relies on the disclosure from Chang of a prior art microcolumn shown in Figs. 1-3 of that patent. The microcolumn includes a field emitter source 40 and microsource lens 52 having an extractor and anode.

Lee is directed to an alignment technique for microlenses and microcolumns in which fibers (e.g., optical fibers 59a, 59b) are used to precisely align multiple layers of the microstructure.

These references do not teach or suggest, either singly or in combination, the features of claim 1. In particular, amended claim 1 is directed to a particle beam generator which includes an extractor plate, particle accelerating means, and collimating means wherein, by disposing the extractor plate close to the particle source (e.g., within a few hundred nanometers) and providing an electric field to either side of the extracting aperture, there is provided a focusing effect which inhibits lateral expansion such that the particle beam diameter is less than 100nm. This feature of amended claim 1 is recited in the claim as:

> said extracting plate is disposed sufficiently close to said particle source such that this proximity, in combination with the provision of an electric field applied to either side of said extracting aperture to provide a focusing effect on the particle beam passing through the extracting aperture, together inhibit lateral expansion of said particle beam such that it has a diameter of less than 100nm.

Support for these features can be found in the PCT specification at Page 8, ¶¶ 2-3, and Page 9, ¶ 1.

Neither Chang nor Lee teach the use and application of a suitable electric field to the extraction plate to provide a focussing effect on the beam. Nor do they teach the claimed

feature of focusing of the particle beam at the extracting plate to within the specified diameter by utilizing a combination of small (sub micron) source to extractor plate spacing and an electric field applied to either side of the extractor aperture. Rather, given the teachings of the two cited references, it would seem that the combination of those references would instead simply lead one of ordinary skill in the art to utilize Lee's fiber alignment method to precisely align the different microstructure layers in the Chang prior art device.

As discussed in Applicant's specification, "nano-scale" implementation of the device recited in claim 1 is the result of the combined fact that the extracting plate is close (and this word must be construed in the nano-scale) to the particle source, and that an electric field is applied so as to provide a focussing effect (as opposed to a simple potential difference which merely causes particle emission from the source, as in the Chang reference) on the particle beam as it passes through the extracting aperture. If this did not occur, the particle beam would expand to the point of becoming diffuse, and thus be of no use in either nanotechnological SEM or in any nanotechnological active surface alteration procedure, such as drilling, erosion, abrasion etc.

It is also worth noting that while a focussed particle beam having a width of around 100nm or less and being of a particular energy is useful for nanotechnological SEM or active surface alteration (as opposed to scanning) procedures, the working distance and overall dimensions of Applicant's device, and that according to the Chang and Lee prior art references, are very different. (See line 59, col. 1 of Chang.) In Chang, the working distance is expressed in the order of 1-5mm, whereas in Applicant's device, the working distance is expressed in tens or hundreds of nanometers, a factor of at least 10^3 different.

It is the focussing effect of the electric field which also allows the devices made according to the present invention to be physically of true nano-scale proportions.

To expand further on this point, if one scales down the size of the aperture through which the electrons pass and disposes the nanotip sufficiently close to the aperture so that the beam does not expand out of the nanometer range, then for the beam expansion to be controlled so as to prevent aberration dominating, an electric field is needed immediately following the aperture. This field combined with the aperture disposition relative to the

nanotip therefore prevents expansion of the beam and it can be transported over microscale (which are essentially quite large compared to nano-scale) distances before it becomes greater then 100nm. This enables the beam to be focussed down to atomic dimensions without collimation if a suitable electrostatic lens is placed at a point where the beam has expanded to less than 100nm.

In existing systems all the elements are of microscale or larger dimensions and the beam is controlled after the nanotip using an electrostatic lens at least a few hundred microns in length. This means the beam always expands into the microscale region and hence its brightness is limited by aberrations and it cannot be focussed down to small dimension without severe collimation. Also it should be pointed out that this focal length of the final lens must be less than 20 microns to enable one to focus down to the smallest sizes unless a very complex aberration corrected lens is used. Such lenses cannot function without active computer control (adaptive optics) and these arrangements are extremely expensive (typically in the millions of dollars).

Finally, Applicant notes that the means by which the invention of claim 1 "inhibits lateral expansion" is not a result of collimation in which a beam of a certain diameter passes through an aperture of a lesser diameter and therefore automatically is reduced in diameter to that of the aperture, but rather is the result of focusing at the extractor plate due to the applied electric field which changes the characteristics of the beam, e.g. in terms of energy, diameter, intensity, degree of aberrations etc.

Given that neither Chang nor Lee teach or suggest the above-quoted combination of features, Applicant respectfully submits that claim 1 patentably defines over these references. Claims 2-17 each ultimately depend from claim 1 and should be allowable therewith.

Applicant is submitting herewith an Information Disclosure Statement covering additional references cited from a foreign patent office. These references have been reviewed and it is submitted that neither discloses the combination of features quoted above from claim 1.

In view of the foregoing, Applicants respectfully submit that the application is in condition for allowance. Reconsideration is therefore requested. The Examiner is invited to telephone the undersigned if doing so would advance prosecution of this case.

The Commissioner is hereby authorized to charge a one-month extension of time fee and the fee for the Information Disclosure Statement, as well as any deficiencies in fees, or credit any overpayment associated with this communication to Deposit Account No. 50-0852.

Respectfully submitted,
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